# Introduction to Digital Photography
# Session 2 – Camera Mechanics

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Learn the rules like a pro, so you can break them like an artist.

Pablo Picasso

# Agenda

- Camera Types
- Camera Parts
- Sensors
- Crop Factor
- Brands
- Exposure Modes
- Shooting Modes
- Metering Modes
- Focus Modes
- Lenses
- Image Stabilization
- Memory
- Filters
- Flash
- Gadgets
- Display Options
- Find the Buttons
- Now What?

We may not get through all this in one hour, but I've included all of the slides for your reference.

# Camera Types

"Pocket" Camera





"Point and Shoot" Compact


<u>DSLR</u>
Digital Single Lens Reflex

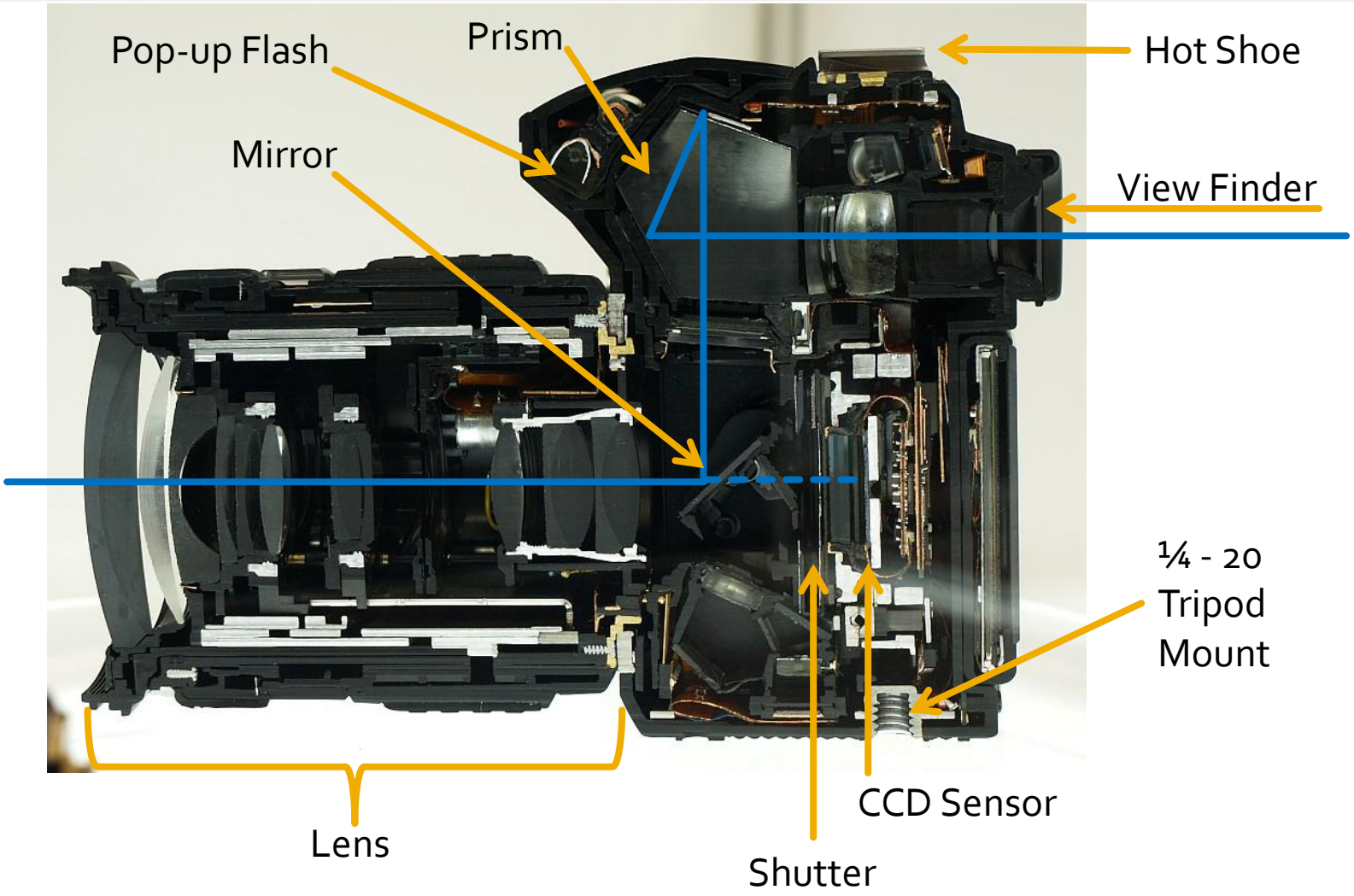

DigiCamReview

<u>ILC</u>
(Mirrorless) Interchangeable Lens Compact

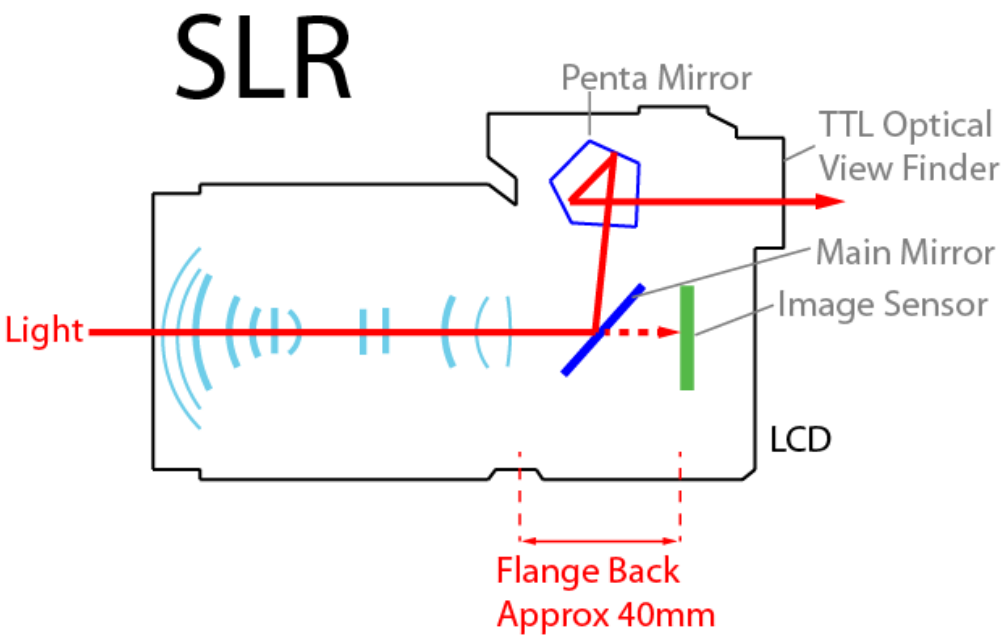
# Camera Parts

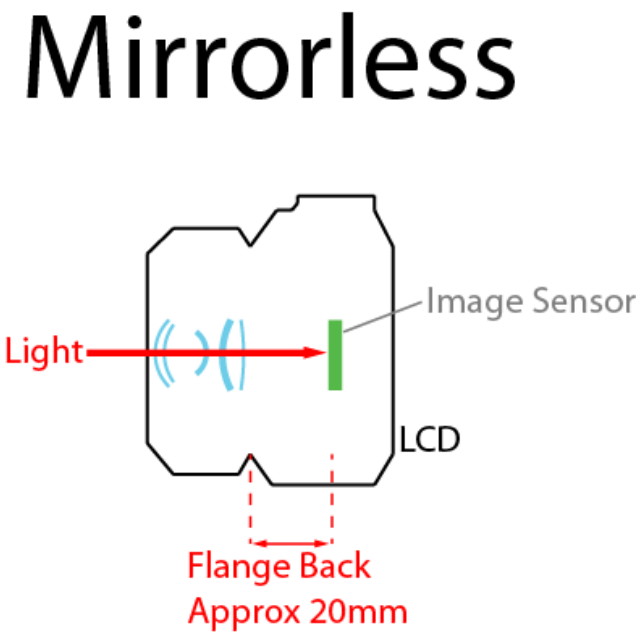
- All digital cameras have:
  - Lens
  - Shutter
  - Shutter release
  - Sensor
  - Computer
  - Display screen
  - Battery
- Most also have:
  - Viewfinder
  - Built-in flash
  - ¼ - 20 tripod mount
- Some Have:
  - Hot shoe
  - Mirror / prism
  - Grip
  - Selection dial(s)

# What's inside a DSLR?



# Construction of DSLR and Mirrorless Cameras



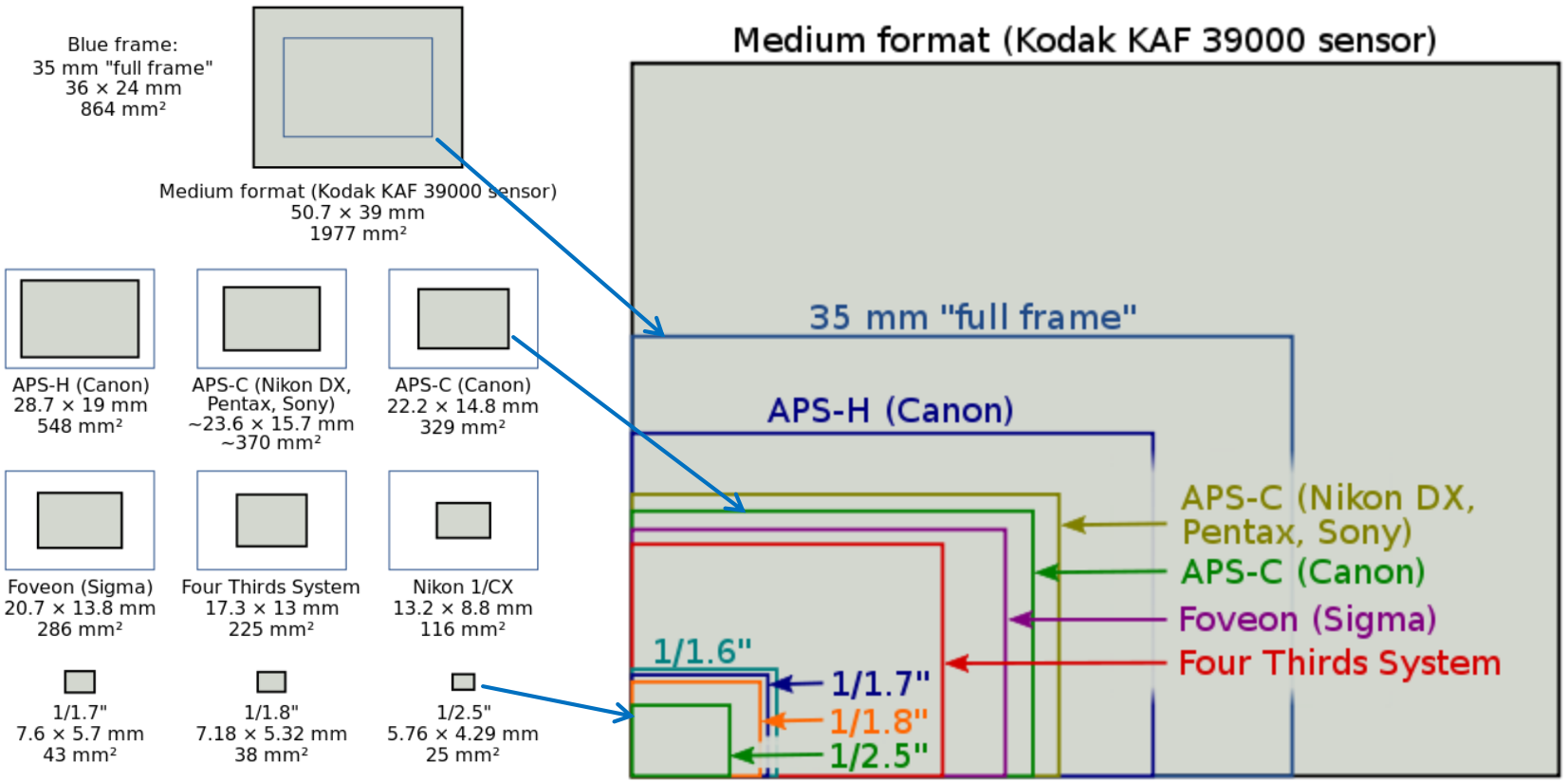




https://www.photoblog.com/learn/decide-mirrorless-camera-right-for-you

# Mirrorless camera advantages

- Smaller and lighter camera and lenses
- Less vibration
- What you see is what you get
  - Adjust brightness before taking the shot
  - See the depth of focus through the viewfinder
  - Focus zoom in viewfinder
- Review your shot instantly in the viewfinder
- Playback with less glare
- Combine with a touch screen
  - Quickly designate the focus point
  - Easily move around zoomed images in playback
  - Quickly change settings by touching the setting

# Sensors (size does matter)




- Blue box is 35 mm film frame
- The difference (white area) is the crop factor

# Crop Factor

- Reported relative to 35 mm film
- Same focal length lens that was used on film camera now focuses onto a smaller sensor
- **The sensor image area becomes expanded when viewing, so it is effectively magnified**
- Because of this, a 100 mm lens on a Canon APS-C camera gives the same magnification image as a 160 mm lens would on 35 mm film

# Brand Selection

- Canon and Nikon have traditionally led the market in DSLRs
- Sony, Olympus, Canon, and Nikon all have competing mirrorless designs
- Brand loyalty
  - Largely driven by cost of buying new lenses
  - Somewhat driven by design philosophy
  - Hard to overcome as technology evolves
- A lot to consider when buying your first camera

# Camera Settings

- Exposure Modes
- Shooting Modes
- Scene Modes
- Focus Modes
- Metering/ Exposure Compensation
- File Type/ Image Quality
- White Balance
- Playback
- A whole book full of others – read that book!

(the User's Manual)

# Exposure Modes – A PASM

**Fully Automatic**

Auto
- Camera selects everything: aperture, shutter speed, focus, flash all of it, usually with no overrides
- Usually works well, sometimes disappoints

Program
- Camera picks aperture & shutter speed; focus can be overridden

**Semi-Automatic**

Aperture Priority
- User picks the aperture, camera picks the shutter speed to match
- Often the preferred go-to mode for experienced photographers

Shutter Priority
- User picks the shutter speed, camera picks the aperture to match

**Fully Manual**

Manual
- User gets to/ has to pick all settings

# Shooting Modes

- Single shot
- Burst
  - High/Low speed bursts
- Self-timer
- Mirror lock-up
- Remote control
- Bulb
- Bracketing for HDR

# Scene Modes

- Portrait
- Landscape
- Night Scene
- Night Portrait
- Sports
- Indoor
- Macro
- Self Portrait
- Sunset
- Fireworks
- Food
- Documents
- Beach/Snow
- Underwater (4 options)
- Snow
- Close-up
- Museum
- Backlight
- Panorama
- Candle
- Probably many more…

# A Few Common Scene Modes

- Sports
  - Increases ISO, opens aperture, for faster shutter speed
- Landscape
  - Chooses narrower aperture, for longer depth of field
- Portrait
  - Chooses wider aperture, for short depth of field
- Night Portrait
  - Long exposure for background, plus flash for faces
- Fireworks
  - VERY long exposure (seconds) – should use a tripod
- Beach/Snow
  - Compensates for bright reflections by increasing exposure
- Night Scene
  - Increases ISO, for greater light collection, no flash

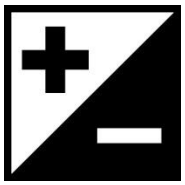
# Metering Modes

- Multi-zone (evaluative, matrix)
  - Evaluates whole scene (60% center, 40% other)

- Center-weight (partial)
  - Gives preference to exposure of central (~10%) area

- Spot
  - Gives preference to small (~2-3%) area in the center
  - Gives precise control over exposure in a specific spot

- Half-press the shutter release to hold the exposure
- Exposure Compensation: shifts the exposure brighter or darker



# Focus Methods

- Autofocus on most new cameras is pretty darned good
  - Even experienced pros often use it instead of always manually focusing
  - Still not always perfectly crisp
  - Doesn't work for all situations – moving subject
- Very dependent on high contrast areas
- Focus point can usually be defined
- Might still need to tweak with manual focus
  - Be sure to adjust the diopter correctly!
- Manual focus on pocket cameras and point and shoots is difficult, if possible

# Focus Modes

- Single Shot Autofocus
- Single AF with manual tweaking
- Continuous Autofocus
- Continuous with Tracking
- Manual Focus
- Live View focusing aid
  - Magnifies the Live View image
  - Mirrorless offers this in the electronic viewfinder

# Lenses

- Built-in vs. interchangeable
  - Depends on the camera type
- Fixed vs. zoom
  - Fixed is typically lighter and has higher image quality
  - Zoom is more flexible
- Cheap vs. expensive
  - Most manufacturers offer two or three levels
  - More expensive lenses have more elements, better coatings, wider apertures, heavier weight
- Macro capability
  - Highly detailed close-up images
- Teleconverters
  - Goes between camera and lens to produce 1.4, 1.6, or even 2.0 x the focal length

# Zoom Lens Cautions

- A 'wiggle' of only 0.03° will cause the image to move by 1/8" at 20 feet
  - With a 50 mm lens, you may not see that
  - With a 400 mm lens, it is 8 times bigger, and very noticeable
- Zoom lenses are also usually unbalanced when hand held
  - More likely to get that 0.03° wiggle - or more
- **General rule of thumb for hand-holding an exposure:**

  **Shutter Speed ≤ 1/Focal Length**
- They also tend to have smaller maximum apertures, leading to longer exposure times
- Tripods help, but faster shutter speeds are more practical
  - Tripod pointing is awkward and slow
  - Faster shutter usually means higher ISO, though → more noise
- Thus, the driver for more expensive, "faster" zoom lenses

# Image Stabilization

- Uses tiny accelerometers to detect movement
- Optical Image Stabilization
  - Lens shifts the optical path, to stabilize the image
  - Unique to the lens; extra $ for each lens
  - Canon and Nikon mostly
- Sensor shift
  - Sensor is moved to stabilize image
  - Works with all lenses, even old film lenses
  - Olympus, Pentax, Sony, new Canon and Nikon
- Digital Image Stabilization
  - Used in some video cameras
  - Computer changes the pixel region from frame to frame
- Performance is rated in equivalent stops improvement
- Turn image stabilization OFF when using a tripod

# Filters

- Ultraviolet
  - Mostly to protect the lens
  - Cheap, and nearly invisible in the image
- Polarizer
  - Reduces glare and reflections; great for rainbows
  - Rotate for best effectiveness
- Infrared
  - Sees heat, for an 'other-worldly' effect
- Neutral Density
  - Reduces light, without shifting colors, for longer exposures
- Color
  - Highlights individual colors
- Gradient
  - Neutral density on one end to clear on the other
  - Great for darkening skies

# Memory

- Most cameras have two types of memory
  - Internal – holds the picture right after you shoot
  - Removable cards– for downloading to a computer
- Card formats
  - Limited by the camera
  - Compact Flash – bigger, faster, often cheaper
  - Secure Digital – SD, mini SD, micro SD, SDHC, SDXC
- Make sure you don't over-buy: check the manual

# Flash

- Obviously used to brighten a scene
- Flash power is determined by the Guide Number
  - GN = distance x aperture, at a specific ISO
  - Example: 18m at ISO 200 (Olympus E-5 internal)
  - Means that at f/5.6 and 200 ISO, anything beyond 3.2 m (~11 ft) will not be fully illuminated
- External flash
  - GN is typically about 30 to 50
  - Can be moved off-axis, to control shadows
  - Many are remote triggered; can use multiple units

# Gadgets

- Tripod
- Spare batteries
- Camera Bag
- Spare memory cards
- Monopod
- Shutter release
- Intervalometer
- Remote control
- Lens caps
- Reflectors/ diffusers
- GPS data tagger
- The list goes on and on…

# What next?

Now that I figured out my camera and I'm taking great pictures, I have a bunch of pretty files. What can I do with them?

- Photoshop / Post-processing
  - If you think they look great now, just wait…
  - Elements has the same basic tools in a simpler interface
- Prints
  - Costco does a surprisingly good job cheap
  - Probably not worth getting your own printer
    - Usually clog up if you don't print a lot of pictures
- Create a photo book about a subject (cheaper than you think)
  - Online software makes it pretty easy
- Post them online
  - Recommend a Flickr free account
  - Photo Club Flickr site – we want to see what you've done!
  - Facebook, other social media

# Recommended References

- Your camera User's Manual – read it!
  - Download it to your smart phone for easy searching
  - Carry it in your camera bag for reference
- Web sites
  - www.DPReview.com
  - www.photoextremist.com
  - https://www.dpmag.com/
- TV show Wild Photo Adventures http://www.wildphotoadventures.com/
- Magazines
  - Outdoor Photographer
  - Lots of good British magazines

# Button, button, who's got the button?

Power Switch
Shutter Release
Exposure Compensation
Playback
Live View
Diopter Adjustment
Lens Alignment Mark
Lens Release Button
Depth of Field Preview
AF Point Selection
Auto-Exposure Lock AEL
Aperture Adjustment
Shutter Speed Adjustment
Sensitivity Adjustment
Self-Timer
Continuous/ Sequential Shooting
Erase
Flash
Flash Adjustment
White Balance WB

# Backup Slides

# Answers to last week's exercises

- Aperture
  - Complete these sequences of apertures:
  - f/2, f/2.8, f/4, **f/5.6**, f/8, f/11, **f/16**, f/22
    What do you notice about every other one? **Multiples of 2x**
  - f/5.6, f/6.3, f/7.1, **f/8**, f/9, f/**oops!**, f/10, f/11, f/13, **f/14**, f/16
    You can use your camera to find the 1/3 stops
- You're shooting at f/6.3, 1/400 sec, 200 ISO, and you want 1 stop more depth of field. What settings would give you that with the same final exposure?

**f/9, 1/400 sec, 400 ISO  f/9, 1/200, 200 ISO  other equivalent combinations**

- You're shooting in the early evening at your widest aperture (f/4), 800 ISO, and 1/60 sec. You're starting to get blurry images. What new settings might help?

**f/4, 1600 ISO, 1/125 sec  f/4, 3200 ISO, 1/250 sec  other equivalent combinations**

- The shots you got last weekend at f/16, 1/2000 sec, and ISO 3200 were sharp but kind of grainy when you downloaded them. What settings might have been better?

**f/16, 1/500 sec, 800 ISO  other equivalent combinations (reduce the sensitivity)**

- What file format (JPEG or raw) do you think matches *your* current capabilities and needs best? (**there is no answer that is right for everybody**, and your best choice might even be a combination)

# Exercises

- Depth of Field
  - Select a subject separated from a detailed background, or an inclined floor (grass or carpet)
  - Use manual focus on the subject and aperture priority mode
  - Shoot a set of images at each of the whole stops (2.8, 4, 5.6, 8,…)
  - Compare the area in focus in each
- Repeat, but changing ISO by full stops and keep constant f/8
  - Notice where the image starts to get grainy for your camera
- Repeat, but changing only the white balance
  - Which image matches reality? Did Auto WB pick correctly?
- Speed
  - Use manual focus and shutter priority mode
  - Focusing on the street, hold your camera steady, and shoot images of moving cars at 1 sec, ½ sec, ¼ sec,… to the fastest your camera will go
  - Compare the ability to stop the action vs. shutter speed
  - Also notice what happens to the steady background in each shot
  - Do the same thing while panning

# More Exercises

- Minimum focusing distance
  - Take a picture straight-on of a newspaper page, at your lowest zoom focal length
    - Move closer, until the auto focus won't focus any more
    - Repeat at the highest zoom focal length
    - Compare the highest magnification and the working distance
- Image stabilization
  - Hand-hold, without IS, in shutter priority, and take longer and longer exposures of the same sharp subject
    - Where does the image get soft?
    - Repeat with IS on, if you have it
    - Repeat at different zoom focal lengths